Form ESA-B4. Summary Report for United States Steel Corporation
Granite City Works
ESA-130-3 Public Report - Final

Company	United States Steel Corporation	**ESA Dates**	23-26 June 2008
Plant	Granite City Works	**ESA Type**	Fan
Product	Integrated Steel Mill	**ESA Specialist**	Ron Wroblewski

Brief Narrative Summary Report for the Energy Savings Assessment:

Introduction: This report summarizes the opportunities for improvement in some of the plant systems

Objective of ESA: The objective was to look at fans in each division that showed the highest potential for optimization.

Focus of Assessment: Fans in the iron making process, steel making process, and hot strip rolling mill were examined for potential opportunities.

Approach for ESA: The first afternoon of the assessment was spent in a meeting talking about the various fans and looking at process flow diagrams. The second day morning was spent in training as an introduction to fan system efficiency and the Fan System Assessment tool. The afternoon of the second day and the morning of the third Day were spent looking at fans and gathering data. The last afternoon we crunched numbers and developed a PowerPoint presentation to summarize the findings.

General Observations of Potential Opportunities:
- Indicate total plant natural gas consumption for base year, 2006: 9,577,298 MMBtu
- Indicate total plant electricity consumption for base year, 2006: 552,283,000 kWh
- Note what you would expect would be Near Term, Medium Term, Long Term opportunities. See definitions below:

B Furnace Stove Fan – Medium term opportunity
Three direct drive 400 hp 2300 volt fans serving the B Furnace in the iron making process are damper controlled and relatively heavily throttled (30% 38% 58%). Preliminary indications are that this system is not operating very efficiently. The fans seem to be operating at a lower efficiency than what is indicated by manufacturer's catalog curve information, even taking into account the damper position. The cause of the inefficiency is not known at this time. Further investigations are definitely warranted to determine system performance by measuring flow, pressure and power. After testing, additional fan application engineering is needed to determine the best replacement options, but preliminary indications are that the new fans might be only 200 or 150 hp. Savings presented in this report are for replacing the fans with highly-efficient, appropriately sized fans. Savings of applying adjustable speed drives to these existing fans will be somewhat lower than the savings presented due to the inefficiency of the existing fans. The adjustable speed drives will reduce the losses from the control, but won't do anything about the inefficiency of the fan itself. The proposal on the table to purchase drives seems somewhat expensive relative to correctly re-engineering the fans to match the needs of the process. The lower horsepower fans can be comfortably powered by low voltage motors, and the savings on the drives (Less hp and no medium voltage) will probably pay for a substantial percentage of the cost of replacement fans relative to the 400 hp medium voltage drives being considered.

Precipitator fans in Steel making operations – Medium term opportunity
Three direct drive 1000 hp 2300 volt fans serving the precipitator in the steel making process are damper controlled and cycle open and closed to varying degrees to track the exhaust air required during different parts of the cycle. During the blow portion, maximum flow (900,000 acfm) is required, and when the ladle is idle, the flow rate will drop to 250,000 acfm. Preliminary indications are that this system is operating with an efficiency of 30% at high flow, which is about half as well as an optimally matched fan could do. The exact cause of the inefficiency is not known at this time. Further investigations are definitely warranted to determine system performance by measuring flow, pressure and power. After testing, additional fan application engineering is needed to determine if fan or impeller replacement is a viable option. Preliminary indications are that the new fans might be in the size range of 400 or 350 hp, though they may be similar in physical dimensions to the present fans. Savings presented in this report are for replacing the fans with highly-efficient, appropriately sized fans. There is a lot of variation in the airflow rate required, but since 1000 hp medium voltage drives are prohibitively expensive, this option has not received serious consideration. Purchasing Medium voltage ASDs for these fans without re-engineering the fan application is not recommended. However, since the efficiency at low flow was estimated at only 6%, there clearly is an opportunity. The lower horsepower fans can be powered by low voltage motors, which might make it feasible to consider using adjustable speed drives to capture this opportunity. Also, since the fans are arranged outside at ground level, the fans can be changed out one at a time with no interruption to the process.

ID fans in Steel Hot Mill operations Furnace #1, #2, & #3 – Near term opportunity
Each Furnace is served by a 350 hp belt-drive induced Draft Fan that is operating against a mostly closed variable Inlet Vane. During the walk-through, the operators demonstrated that the dampers basically are immovable. There is a great and low cost opportunity here to slow down the fans by changing the pulley ratio. In fact the fans are developing so little draft with the dampers closed that it may be possible to extend the height of the stacks and get enough natural draft to shut these fans off entirely, thus eliminating the belt maintenance, motor maintenance, energy expense, etc.

ID fans in Steel Hot Mill operations Furnace #4 – Medium term opportunity
#4 Furnace is served by a 700 hp direct-drive induced draft (ID) fan that is operating at an efficiency of only 46%. This fan is not severely dampered, so the inefficiencies may be due to the selection of the fan or the condition of the wheel. Savings presented in this report are for replacing the fan with a highly-efficient, appropriately sized fan. This fan is in a tight location, so it may be difficult to replace it without interrupting operations. Additional tests are needed to confirm the preliminary findings before any investment is made. Preliminary investigations indicate that the replacement fan might be in the range of 350-300 hp.

Management Support and Comments:

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